SF258
.S2M5

SF 258
.S2 M5
Copy 1

The Milk Problem in St. Louis

PREPARED BY

ELIZABETH MOORE
AND
MINNIE D. WEISS

UNDER THE DIRECTION OF

GEORGE B. MANGOLD, PH. D.

DEPARTMENT OF RESEARCH

ST. LOUIS SCHOOL OF SOCIAL ECONOMY.

The St. Louis School of Social Economy

A Training School for Social Workers
Affiliated with Washington University

Special Day and Evening Courses

Certificate Course.

Master of Arts Course.

Supervised Practice Work.

Attractive Fellowships.

Low Tuition.

THOMAS J. RILEY, Director

GEORGE B. MANGOLD, Associate Director
Department of Research
(Russell Sage Foundation)

LUCY OPPEN, Assistant and Adviser of Women
Department of Practice

For Information Address

THE DIRECTOR,
The School of Social Economy.
19th and Locust Streets,
St. Louis, Mo.

U. OF D.
JUN 17 1914

SF258
S31M5

CONTENTS.

Chapter I.—Origin and History of the Milk Supply of St. Louis 3

Chapter II.—Condition of the Summer Milk Supply in St. Louis 13

Chapter III.—Relation of Milk to Babies..... 22

Chapter IV.—Milk Regulation in Other Cities..... 30

Recommendations 36

INTRODUCTION.

The St. Louis School of Social Economy has made an extensive study of the cause of infant mortality and sickness in St. Louis. The study included an investigation of all deaths in the second, third and fourth sanitary districts, of children under five years of age for an entire year. A special study was also made of sickness among small children during the summer months, and an additional inquiry was directed into the character of the summer milk supply. In view of the large factor which our investigation shows poor milk to be as a cause of sickness and mortality, this report is offered to the public with the hope that the needed reforms may be accomplished.

The School of Social Economy wishes to express its thanks to the St. Louis Pure Milk Commission and the Missouri Botanical Garden for the generous provision of laboratory facilities for the work embodied in this bulletin; and to the officials of the Health Department and the officers of many dairy companies for assistance in getting much of the information contained therein.

CHAPTER I.

ORIGIN AND HISTORY OF THE MILK SUPPLY OF ST. LOUIS.

Like all large cities, St. Louis draws its milk from a large district, surrounding and including the city. By far the most important part of this district, from a milk-production standpoint, is that in western Illinois, a zone with numerous dairy centers, extending roughly between 20 and 100 miles from the city. In eastern Missouri dairying is not so important a business, and there are only a few centers, with a fair number of scattered dairy farms. Then also there are dairies in and immediately surrounding the city. The conditions of milk production in all these dairies, together with the methods of transporting and handling the milk, both in the country and in the city, are the factors determining whether the milk, which supplies such a vital need of the city, is good or bad, wholesome or unsafe. As far as is possible in a brief account, the more important of these features, from a sanitary standpoint, are discussed in this chapter.

City Dairies.

It is estimated that about one-fourth of the milk sold in St. Louis is produced within the city. Approximately 5,000 cows are kept here, in 175 dairies having from 4 to 150 cows each. Most of these cows stand in the stable month in and month out, many of them without even a chance to move about in a barn-yard; and this confinement is so hard on them that they can be kept only one season. So it is emphatically a question whether the cows can give wholesome milk while living so unhealthy a life. In addition, many of these dairies feed "brewers' slop;" and it is plain that this affects the quality of the milk, for the milk and even the cream from such a dairy is a ghastly, chalky white that differentiates it instantly from country milk.

The cows in the "city" dairies are not tuberculin-tested. Possibly they do come into the city comparatively free from tuberculosis, as is claimed; but since that disease is one of the reasons why cows cannot be kept for any length of time in these places, it does not seem likely that they all remain free from it during the time that they are contributing to our milk supply. Whenever a cow has tuberculosis, there is real danger of the tuberculosis germs (tubercle bacilli) getting into the milk, and then an ever-present pos-

sibility of their doing serious damage. And in the case of the "city" dairy, the milk is almost all sold raw.

On the other hand, these dairies are under the supervision of the Health Department, and most of them are kept decently clean. The stables are required to have sound floors and white-washed walls and ceilings; the cows must be kept clean; the milk-room and all the apparatus must be in decent condition; and the milk must be promptly cooled with ice. These are not the only necessary precautions for sanitary milk production; but it is something—in truth, a good deal—to be assured of even so much. Moreover, the milk from these city dairies gets to the consumer rather promptly, for it is nearly all peddled out by the producer; and as we shall see, this is no inconsiderable advantage. This "city" milk is mostly cheap milk sold from the can; and last summer it was found to contain far less bacteria than other "loose" milk. This is undoubtedly due to its greater freshness.

So there is something to be said on both sides of the question, whether the "city" milk is comparatively good or bad milk. But in any case, it is a diminishing factor of the whole milk problem; for both the number of "city" dairies and the number of cows therein diminish year by year. Dairymen go out of business for one reason or another; and no new cow-stables are allowed to be built. Dairying within the city was at one time the main source of supply for the city; and the dairies which remain are hardly more than a remnant of an obsolete method of handling the business.

Dairies Outside the City.

Meantime, what of the milk which comes from outside the city? In the first place, there is a small amount of milk which is brought in by wagon from the surrounding country, and often delivered by the producer. Some of these county dairies are of the best class, producing milk selling at 15 or 20 cents a quart. Others are of the lowest order, belonging to the most backward and obdurate of the city dairymen, who have moved beyond the city limits in order to get away from the supervision of the Health Department. (Then they can sell as dirty milk as they please.) And of course there are other "just ordinary" country dairies in this group.

But the vast bulk of all our milk—the dominating factor in the situation—is the "shipped" milk: i. e., that which comes into the city by railroad. Where does it come from? From what sort of places? What happens to it, both on its way into the city, and after it arrives?

The "shipped" milk—some thirty thousand gallons a day—comes from 4,500 or 5,000 farms, scattered over eastern Missouri and western Illinois, but most of them located in the dairy zone in Illinois, which furnishes from three-fourths to four-fifths of this supply. Now, to a large extent the character of our milk is determined on these farms; for dirty milk on the farm can not become clean milk, nor bad milk good, although the reverse may all-too-easily happen. What do we know about them? In the first place, that they are

subject to practically no sanitary inspection, so that the milk is at the mercy of the standards of cleanliness of each individual farmer. The inspection officials of the states of Illinois and Missouri are without real authority over sanitation; and so far, St. Louis has done nothing to protect itself. The dairy companies as a rule will accept pretty nearly any milk that does not smell sour when it arrives; and there is plenty of opportunity to pass unwholesome milk through those limits, for milk may be pretty bad from a sanitary standpoint long before it sours or even smells bad.

Condition of the Dairy Farms.

During this investigation, 64 farms selected at random in eleven districts in Illinois and Missouri were visited.

Some distinctly insanitary conditions were found to be very common, if not prevalent. For instance, over half of the cow-stables inspected had dirt floors, most of them without any gutter or drainage arrangements; it is inevitable that such a floor is more or less impregnated with manure, and it easily degenerates into an impossible condition when not well cared for, especially in wet weather. Tight floors—wood or cement—are required practically everywhere that there is any sanitary supervision. That cement floors are not beyond the reach of the farmers of this region is shown by the considerable number who do have them. Then, a large proportion of the barns have no windows at all, while only one-fourth were found to have as much as one square foot of window-space per cow. The official U. S. standard is four square feet. Dusty ceilings are very much in evidence; what is surprising is that no farmer was found who took the simple precaution of whitewashing the inside of his stable, and only a very few who even swept the cow-webs down from their ceilings—generally the only clean ceilings were the new ones. On nearly half the farms, horses and cows were stabled along side of each other or at best on opposite sides of the passage way, which is not a good thing in a milking-barn. The cows keep pretty clean as long as they are out on pasture; but in the winter dirty cows are so much the general rule that a farmer who cleans his cows is a shining exception. On the only inspection trip made in wet weather, every barn-yard was found knee-deep in mud; of course that is hard to remedy, but it is sure eventually to transfer altogether too much of that mud by way of the cows into the milk. Very commonly during the winter the manure is pitched out of the windows and piled up against the barn, or at best a few feet away in the yard; that adds to the cleanliness neither of the barn nor of the barn-yard.

Throughout this investigation, the only farmers who were found to have had their cows tuberculin-tested were an occasional owner of a pure-bred herd. It is impossible without the use of the test to tell anything about how much tuberculosis there is among the cattle, for it is only advanced cases that make themselves evident. Undoubtedly, there is a good deal of it; it has been estimated that 10

A TYPICAL BARNYARD

per cent of the dairy-cattle in Missouri are infected, and where dairying has been long established without protection through testing, as in Illinois, the disease of tuberculosis, which tends to spread, is very likely to be still more prevalent.

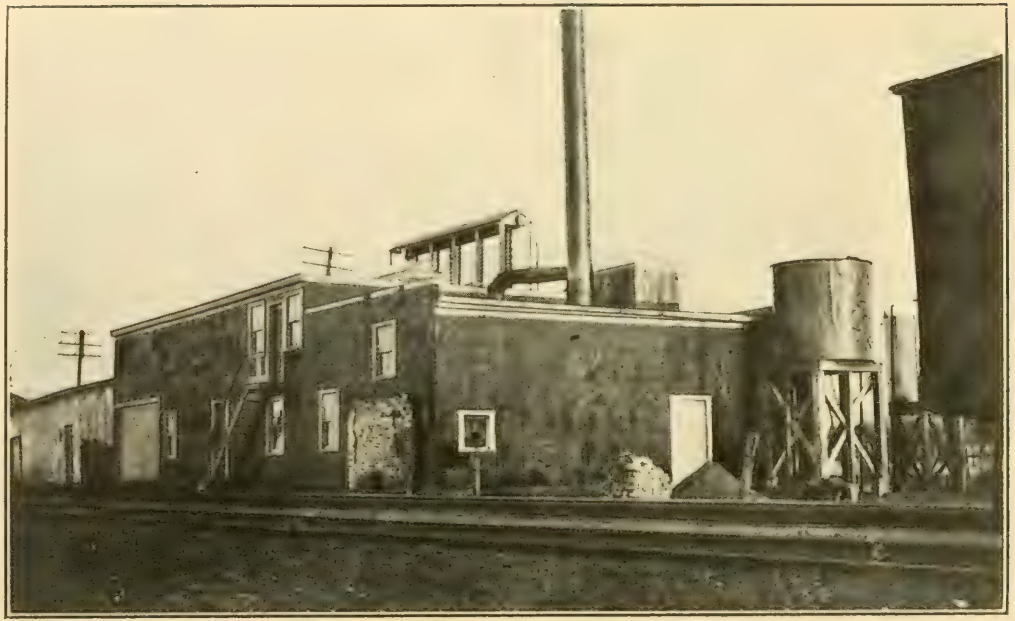
As to methods of handling the milk—aside from the impossibility of getting clean milk from a dirty cow in the dusty barn—the first general criticism to be made is that the practice of filling the milk-cans inside the stable is much too common. Secondly, it has been proved in many places that the use of small-mouthed milking pails is one of the most practicable and effective methods of diminishing the amount of dirt which falls into the milk, especially in dusty surroundings; but no such pails were seen. Finally, the cooling of the milk on the farm is distinctly ineffective; it is the custom to cool the milk by setting a large 8-gallon can in a tub or tank of well-water, but this will cool the milk neither quickly enough nor cold enough to make it really fit to be shipped to the city. When we find the Boston authorities insisting on "a liberal use of ice" by the farmer, even in the cooler New England climate, we must realize that we have an unfortunate situation to face, in that we draw milk from a country where there is no ice on the farms.

This state of things could be improved by an authoritative inspection service. Doubtless the improvement would be rather slow, and naturally some bad conditions would be more difficult to remedy than others; but eventually a great deal of good could be accomplished.

There are other conditions, worse but not so general, which were found in occasional distinctly "bad" dairies; for example, a stable floor which in dry weather was a trampled mass of filthy mud, a wooden floor hidden under accumulated manure or a cement floor that was a pool of filth, stables where hay and cob-webs can sift their dust into the milk, unimpeded by any ceiling, cows whose sides and udders were caked with manure (apparently "for the winter"), milk-buckets left on the dusty floor of a dirty barn, or cans left unwashed until afternoon or even the next day and then washed with cold water at the barn well. Such things are not the rule, but they are actual cases; and the milk from such farms is mixed with that from better ones, contaminating it all. For in handling milk, "the chain is no stronger than its weakest link." Because there are better farms is no reason for tolerating the bad ones; on the contrary, it only shows that the notably bad ones are inexcusable. It is here that inspection would be most immediately effective, in eliminating such conditions and practices; and evidently we can trust only to official inspection to perform this service for us.

Collecting Stations.

Some of the milk from the farms is shipped directly by the farmer to a distributing dairy in the city. About three-fifths of the milk sent to the city (and most of the cream), however, first passes through the hands of a collecting station or "creamery" at the nearest railroad station, which buys the milk from the farmer and as-



A COLLECTING STATION

Showing Shipping Door, Cooling Pipes of the Refrigerating Machine (on the roof) and Water Tank Above the Well

sumes all further responsibility for its progress toward the city. The milk is gathered from the farmers in several ways. The farmer after the milking in the morning may haul his milk directly to the creamery. Sometimes several farmers join in the establishment of a route and the men take turns in hauling the milk of the co-operators. More frequently one farmer on a route is paid by the others for hauling the milk. Whichever method of collecting is used, the milk is not under refrigeration while on the way to the creamery. Frequently the hot sun beats down on the milk cans and hastens the spoiling of the milk.

Half of these creameries, including the largest ones, are owned and operated by the large dairy companies in the city; from the others the milk is bought by contract. At this point the history of the milk differs. Some of the dairy companies, and some of the independent creameries, have their milk pasteurized* at the creamery before it is sent into the city; other creameries rely upon thorough cooling to keep the milk in good condition, or pasteurize it only during hot weather.

Two distinct objects are sought by pasteurization. From the sanitary standpoint, it is a means of destroying the disease-producing germs in the milk; and to be reliable for that purpose, it must be thoroughly done, under the supervision of someone who understands the process. From the point of view of the average dairy-man, it is a means of reducing the miscellaneous bacteria in the milk and thereby making it keep longer. Unfortunately a less efficient pasteurization seems to serve fairly well for this purpose; unfortunately also, the dairy-man may and all too often does use the process as a substitute for carefulness in keeping the milk free from bacteria, or as a makeshift to enable him to keep the milk longer than it ought to be kept. In other words pasteurization delays the souring which is nature's danger-signal of stale milk. Nearly all the "shipped" milk in St. Louis is pasteurized. The milk which is pasteurized at the creamery, is again pasteurized after reaching the city; and to this "double pasteurization" practice there are serious objections. It is not because the repeated heating injures the milk chemically—it probably does not—but rather because, when the same milk is pasteurized twice, it means in plain language that that milk has been allowed to get well on toward the spoiling point TWICE—that it is raising its third crop of bacteria when it reaches the consumer and is loaded down with the remains of the two previous crops. If repasteurization were prohibited, arrangements would have to be made to deliver fresher milk.

In any case, whether pasteurized or not (but more commonly when pasteurized), much of the milk remains at the creamery until

*Note: Pasteurization is the trade name for the process of heating milk to a temperature considerably below the boiling-point, 140 degrees to 160 degrees, in order to kill the bacteria which it contains. The commercial process consists in running the milk through a heating machine made for the purpose, of which there are several types, and then cooling it, which is equally important.

the second day. At stations where the milk-train leaves early in the morning, this can hardly be avoided; but in some cases the train does not go until 8 or 9 or even 10 o'clock, and still from one-third to two-thirds of the milk from that station will not be ready for it, but must wait until the next day. Where the milk is pasteurized, the delay is made almost inevitable by the time which that process requires; but in some instances it is due merely to a lack of insistence on prompt delivery from the farmers. In other cases a possible afternoon train is not utilized because it would be "inconvenient" to the dealer to receive milk late in the day.

All the creameries have means of cooling their milk—ice, or refrigerating machines—and have refrigerator rooms or iced storage tanks for holding it when necessary. This cooling is generally efficient, often bringing the temperature of the milk down to 40 degrees. And the milk seems very generally to be handled in a cleanly manner, though of course some of the creameries are much better built and equipped than others. One weak point in the system is, that in many places the water supply is taken from a shallow well, located typically along side of the building, or in or near the railroad ditch, and either uncovered or exposed to surface drainage. Some creameries provide facilities for the farmers to wash and steam their cans, and a few require it to be done; it would be well if this were the case everywhere, as cans so cleaned are in much better condition than those left unwashed for some time after emptying and then washed without steaming.

Transportation.

While milk is being transported to the city, it is subjected to most unfavorable conditions. For, incredible as it may seem, there is no cooling or icing of the milk on the cars in transit, even in summer-time. Our milk comes to us from 50 to 100 miles away on slow local trains, requiring a journey of two or even three hours, sometimes in the heat of the day, with no protection from the summer sun except the roof of the car. This is bad enough for the milk which starts from a creamery storage room at 40 degrees, but it is even worse for the milk coming directly from the farmer's well-tank at a temperature not below 55 degrees or 60 degrees. Indeed it is a wonder that any of the direct shipments arrive sweet in the summer. This is a condition which would not be tolerated in any other first-class city; and it would undoubtedly be remedied promptly enough if our ordinance requiring milk to be kept cold (below 50 degrees) could be enforced, as in New York, by the confiscation and destruction of all milk arriving too warm.

Distribution.

After the milk reaches the city, it passes for distribution into the hands of some one of the forty-odd dealers in "shipped" milk. Fully half of these are men who receive and store a few cans of milk from a few farmers, and retail it in their immediate neighbor-

hood, possibly bottling some of it. Such dealers make their business very much of a "family affair," being assisted by members of the family in washing, bottling and selling, and carrying on these operations close to the living-rooms. Hence it seems likely that, in common with the "city" milk handled in similar establishments, this milk is rather more liable to disease-contamination than that of the larger plants which is handled in a wholesale way, by machine.

City Milk Plants.

The larger dealers in "shipped" milk all pasteurize their output, in the city. As a general thing, the milk which they receive one morning is pasteurized (and bottled so far as that is done) that day and delivered to the customers the following morning. Thus, that part of the supply which, coming through the creameries, has been already held in the country over one night, is in at least its third day—48 to 60 hours old—when it reaches us; and in the winter, when conditions of temperature are better, there is a good chance of its being 24 hours older still, because then many farmers deliver their milk to the creamery only every other day. The milk shipped directly from the farmer is not so old; but on the other hand it is not so thoroughly cooled before coming to the city.

The plants where the pasteurized milk is handled are of all degrees of excellence, and the reverse. A number are located in unfortunately close proximity to their own stables. There are indications that in one or two places the incoming milk is tested by the man in charge sticking his finger into each can and licking the milk off. There is one plant—not a small one either—where the bottles are washed out in the driveway, and the pasteurizer, a dilapidated machine with rusty pipes, most inefficiently operated, is located in a dark, damp, dirty cellar, opening on the sidewalk, and with the ceiling encrusted with dirt directly above the open milk-tank. On the other hand, there are milk-plants which are almost models, and in which the milk is treated with scrupulous care.

Certainly if the consumers would adopt the habit of visiting the depots from which their milk comes, such a place as the one described above which bears its defects so plainly upon its face would be put out of business. But meantime, such conditions, and others not so obvious, ought not to be allowed; and the Health Department (which is fully aware of their iniquity) should be given the necessary authority to end them. At present about all that the Sanitary Division officers can do with an insanitary milk-plant is to adopt a policy of constant nagging; and although within a year they have had the satisfaction of seeing one of the worst in the city finally torn down and rebuilt, still they ought to be enabled to take more peremptory measures.

Then too, pasteurization is a process which requires careful and expert management, to avoid the pit-falls lurking in insufficient heating, insufficient cooling, and contamination after pasteurization; and it is only to be expected that the smaller plants especially lack trained managers and foremen (but any foreman may become care-

less or unduly economical) and need supervision. For instance in one of the smaller plants, in most respects a first-class place, the pasteurization consisted of momentarily heating the milk to 150-152 degrees, and of then cooling it to about 60 degrees—both steps thoroughly inefficient for destroying and preventing the growth of bacteria. If we are to have "pasteurized milk" upon whose wholesomeness we can in any way depend, we shall have to provide official supervision of the process. Otherwise "the last state of the milk will be worse than the first."

Each year, a constantly increasing proportion of all our milk is bottled; and the best dairies bottle all their retail milk. This is undoubtedly an excellent thing; for bottled milk is almost invariably found to be in much better condition than "loose" milk from the same plant. But—to what extent are we protected against infected bottles, for instance from a case of consumption? There is no general enforcement of sterilization, and it is pretty safe to say that where the bottles are not steamed at all—and in many plants they are only washed by hand—they are dangerous. This is one of the important matters which must be strictly looked after, if bottling is to be the safeguard which it should be.

Of course all these statements must not be taken to apply universally to all of our milk, or to all of the companies or individuals who handle it on its way to us. Some are liable to very little criticism; and many are doing the best which they see, to provide good milk—a hard problem at best. But the evils spoken of do exist, and are not isolated instances. And in planning to improve the situation, we must keep in mind the bad conditions, which are the ones that need reforming. If any dairy conducts its business according to high standards, surely that dairy will be the last one to object to the elimination of practices of which it would not be guilty.

To recapitulate: It appears from this investigation that the chief evils from which the bulk of our milk-supply suffers are—

(1) Uninspected, and hence in many instances insanitary, dairy-farms.

(2) Too great delay in delivery to the consumer.

(3) Lack of cooling on the trains.

(4) Unregulated pasteurization.

(5) In some cases, insanitary distributing plants.

CHAPTER II.

CONDITION OF THE SUMMER MILK SUPPLY IN ST. LOUIS.

During the summer of 1910, a number of samples of milk from thirty different dairies were examined, in order to ascertain the condition and quality of our milk as we get it in the summer. As far as possible milk was selected which was being used for sick babies, because it is to them that the condition of the milk is most vitally important. The samples included all sorts and conditions of milk, from all sorts of sources—from both the large and the small dairies, both "city" and "shipped" milk, both "loose" and bottled milk, both raw and pasteurized milk. Some of them were bought from the dairies themselves or from their wagons, others from stores, and still others from the homes of customers.

Chemical Composition of the Milk.

The first question which was investigated related to the chemical composition of the milk: (1) whether the milk had been adulterated by the addition of artificial coloring, or preservatives; (2) whether it had been skimmed; (3) whether it had been watered—in other words, whether the customers were cheated out of the amount of nourishment which ought to be contained in their milk. All these points are covered by the provisions of our present milk ordinance, which are effectively enforced by the staff of the City Chemist's office as far as its numbers permit; but it is obvious that two inspectors taking samples cannot fully control all the milk sold in a city of the size of St. Louis, from 3,000 stores and 500 wagons. The officials are continually finding violations; and it is not surprising that the School of Social Economy did also.

(1) We found artificial coloring once, and formaldehyde once. Formaldehyde is by far the most commonly used milk-preservative, so no tests were made for other preservatives. Last summer formaldehyde was repeatedly found by the Department of Health in the milk of one dairy—the same one in whose milk we found it; but in general it appears that the practice of using preservatives is largely stamped out.

(2) The St. Louis ordinance requires that milk which is sold as whole milk shall contain at least 3 per cent of butter-fat. This is rather a low standard. The requirement in a number of cities is 3.5 per cent; the dairy companies themselves object to taking milk

from the farmers which contains less than 3.5 per cent; and the Missouri State Standard is 3.25 per cent. In case the butter-fat in a mixed lot of milk from different herds falls below 3 per cent, it is a good sign that some of the cream has been removed. We found that practically all the bottled milk samples contained over 3 per cent of fat, and nearly two-thirds of them, 3.5 per cent or more. But among the "loose" milk samples, only one-sixth were above the standard; and one-third were below even 2 per cent. This means that nearly all the "loose" milk is partially skimmed, containing about as much fat as ordinary hand-skimmed milk. This would be no fraud if the customers knew what they were buying, but *we* were never told that it was skim-milk, so presumably other customers are likewise left in ignorance. It is difficult to do anything with such cases, because the seller will invariably tell an inspector and the court that he was selling skim-milk. There is a municipal ordinance requiring the display of skim-milk signs where skim-milk is sold, but it has been held up for the present by an adverse decision as to its legality.

During the four months, June to September, 1910, out of the samples taken by the City Chemist's inspectors, and declared to be whole milk, 38 per cent of the store milk and 3 per cent of the wagon milk contained less than 3 per cent of fat. It is impossible to judge how much of these two classes was bottled milk. The most obvious inference is that the wagon-drivers knew enough to declare their skimmed milk as such, while many of the store-keepers did not. The figures are practically the same for the eight months, April to November; since November there has been sufficient improvement in the store milk to bring its proportion of milk below the required standard for eleven months down to 25 per cent.

(3) In the same way that skimming is detected by a decrease in the percentage of *fat* in the milk, watering is indicated by a decrease in the percentage of the *other* solid constituents of the milk, called "solids-not-fat." The legal requirement for these is 8.50 per cent—again a fairly low standard, for the average of normal milk is estimated to be about 9 per cent. A reduction of the solids-not-fat from 8.5 per cent to 8.25 per cent indicates the addition of 3 per cent of water; and to 8 per cent, the addition of 6 per cent of water. The percentages in our samples were as follows:

Solids Not Fat.	Interpretation	Bottled Milk 34 Samples	Loose Milk. 31 Samples
8.5% and over.	Not watered.	29%	32%
8.5% to 8.25%	suspicious.	38%	23%
under 8.25%	watered.	32%	45%
under 8%	much watered.	18%	35%

Thus it appears that although about the same proportion of both classes—approximately one-third—was all that was *above* suspicion as to watering, when we come to the samples that were *below* suspicion—i. e. pretty certainly watered—the bottled milk shows up decidedly better than the "loose" milk—32 per cent against 45 per

cent. And when we come to the figures indicating a considerable amount—6 per cent or more—of watering the "loose" milk shows twice as many cases. Indeed it is even worse than that, for the watering of the loose milk is sometimes truly flagrant; we found four samples which contained less than 6 per cent of solids-not-fat, or 30 per cent of added water.

This is a decidedly bad showing. It demonstrates that, aside from sanitary considerations, a quart of "loose" milk for five cents is not so good a bargain in comparison with bottled milk at seven cents, as appears on the surface, since the former is probably skimmed and very likely watered. In other words, the purchaser of a quart of loose milk gets less nourishment—really less milk—than if he had bought bottled milk.

Among all the City Chemist's samples of milk, both whole milk and skim milk, for the four months—June to September—62 per cent of the store milk and 17 per cent of the wagon milk—or 22 per cent of all—contained less than 8.5 per cent of solids-not-fat. Some of these, of course, fell only a little below the standard, and are hardly to be called watered. The figure for the store milk corresponds very closely with what we found in the "loose" milk—68 per cent. There was some improvement in the average for the eight months, April-November; and considerable improvement since then, so that the corresponding figures for eleven months are 37 per cent and 14 per cent. This undoubtedly shows a real and substantial decrease in the amount of watering of the store milk.

Who did this watering, is a difficult question to answer since the milk passes through so many hands. There is some indication that at least part of it originated back on the farm. But in any event, the person who sells the milk to the consumer is legally responsible for the quality of the milk.

Temperature.

In investigating the *sanitary* condition of the milk, there are many things which cannot be told satisfactorily from any examination of samples, but only by following its history carefully from the time it leaves the cow until it reaches the consumer—and after. But there is at least one important factor in the care of the milk, which we can easily check up. This is the temperature at which it is kept. All authorities agree that milk (and most especially milk for the supply of a large city, which has to make a long and devious journey before it reaches the consumer) MUST BE KEPT COLD in order to keep it in even decent condition. And cold in this connection means below 50 degrees. Accordingly St. Louis, like most other cities, has a requirement that milk shall be "maintained until delivered to consumer at or below 50 degrees F." There are no figures available as to the temperature of the milk when it arrives in the city—undoubtedly it is generally too high in warm weather, as explained in the previous chapter—but our experience indicates that even after arrival and probable cooling at the dairy, the proper temperature is seldom maintained.

The following table shows the temperature at which our various purchases of milk were sold to us:

Temperature	Bottled Milk. 25 Samples	Loose Milk. 31 Samples.	Total. 56 Samples.
50 degrees or under....	36%	10%	21%
50 to 60 degrees.....	52%	55%	54%
60 degrees or over.....	12%	35%	25%
Over 50 degrees.....	64%	90%	79%

That is, nearly four-fifths of all samples—and 90 per cent of the "loose" milk—were above the legal temperature when sold, and one-fourth were 10 degrees or more above the standard. This is one point which is already covered by the necessary ordinances; and if it could really be enforced, not only by fines, but also by destruction of warm milk, it would improve our milk supply more than any other equally simple step that could be taken.

Bacteria in Milk.

The best available criterion of the general sanitary condition of a sample of milk is the number of bacteria (expressed as the number per *cubic centimeter) which it contains. This is true for two reasons: first, because it has been found in practice that the wholesomeness of milk, especially for babies, depends very largely upon its freedom from bacteria; and second, because the various insanitary influences which may injuriously affect the milk—dirt from dust, manure, or contaminated utensils, or lack of prompt and efficient cooling, or too-long holding, or any carelessness in handling—are invariably followed by an increase in the number of bacteria. Hence when an unusually large number of bacteria are found, it is a sure sign that *something* has gone wrong. We cannot tell what that "something" was, except in the most general way; that is, we can make a rough inference as to whether the trouble is due to staleness or keeping too warm, or to excessive dirt-contamination. But in any case, the milk is deteriorated, so that the distinction as to cause is not of very great practical importance.

The vast majority of the bacteria commonly found in milk are non-pathogenic; that is, they do not produce any particular disease. When the bacteria or contagion of specific diseases, as tuberculosis, typhoid-fever, diphtheria, or scarlet-fever, do get into the milk, they give rise to the most acute dangers which we have to meet in the milk supply, and also one of the most difficult to guard against. Fortunately such infection of the milk (except that with tuberculosis) is not a common occurrence; and the pathogenic bacteria can almost certainly be destroyed by thoroughly heating the milk. It is true that the presence or absence of large numbers of miscellaneous bacteria in milk does not prove the presence or absence of specific pathogenic species. Nevertheless the *chances* for disease-contami-

*Note: One cubic centimeter equals one-half teaspoonful; or a glass contains about 200 c. c.

WHERE SOME OF OUR MILK COMES FROM

nation are greatest where milk is carelessly handled in any way; and this is exactly the condition which is betrayed by a high bacterial count. Hence such milk must be regarded with suspicion. Moreover, experience has shown that it is actually unwholesome in the sense of being apt to cause digestive disturbances.

Occasionally someone maintains that the bacteria in milk are of no importance to health because they are all the acid-producing bacteria, which are not themselves harmful. But this is not so. Very seldom, except in milk which is sour or getting ready to sour, are the acid-producing bacteria in even a large majority; in over half of our samples we found that these bacteria were less than a majority. The rest are miscellaneous bacteria generally originating from dirt of some kind; some of them are putrefactive bacteria, which tend to decompose or "rot" the milk, giving rise to unpleasant tastes and odors, and making it peculiarly unwholesome.

The *numbers* of bacteria found in milk are always astounding to anyone who is not accustomed to them, being for instance out of all comparison greater than those found in the very worst water. This teeming bacterial life results both from the circumstance that it is very difficult to avoid getting dirt—and the "dirtiest" kind of dirt—into the milk at milking time, and also and especially from the fact that milk is one of the best known foods for bacteria, in which they will grow vigorously and multiply enormously, if given half a chance. This is why it is so extremely important to keep milk cold. The very highest grade of milk, produced and cared for with the greatest precautions, does well if it shows less than 10,000 bacteria per c. c. by the time it is 24 hours old. In St. Louis the requirement for Certified Milk is that it shall not contain more than 30,000. In ordinary market or commercial milk the numbers found are much higher than that, varying from about 100,000 to many millions. A number of cities have an official standard of 500,000 per c. c. for ordinary milk, any milk containing a greater number being regarded as suspicious and subject to investigation. In the largest cities it would probably be necessary, at least in the summer, to set the standard even higher, because their milk comes from greater distances and is therefore older; the standard is 1,000,000 in Chicago (in the summer) and in New York. Such a number—1,000,000 per c. c.—is by no means extraordinary, but with decently-good, *fresh* milk, it should not often be exceeded. When the milk verges toward souring or spoiling, the number of bacteria again takes an enormous leap up into the hundreds of millions; but such milk will almost invariably bear an obvious danger-signal in its taste and odor. If it sours "clean" it is not likely to be so unwholesome as milk of an intermediate bacterial count, having in the neighborhood of 10,000,000 per c. c.

Unfortunately the practice of pasteurizing the milk before selling it, as is so largely done in St. Louis, makes us less able to judge of its conditions from its bacterial content. The bacteria not only exist in the milk, but also "do things" to it; and these changes which take place in the milk remain after the bacteria are killed. Conse-

quently pasteurized milk containing for example 100,000 bacteria per c. c. cannot be put in the same class with raw milk containing the same number; for the former when it was raw, probably contained from 1,000,000 to 10,000,000 per c. c., all of whose by-products are still in the milk. This consideration must be borne in mind in interpreting and comparing the bacterial counts of pasteurized and unpasteurized milk. (It is not denied in the least that, generally, milk of commercial grade and miscellaneous origin will be safer and more wholesome after pasteurization than before.)

In our summer investigation, the numbers of bacteria were determined in all the samples of milk which we examined; these came from all sorts of sources, as previously explained. In order to give the information about the commercial-milk samples as briefly as possible, they have been arranged in groups and the averages for the different groups are given in the table. In several of the classes there were one or two samples which had to be thrown out because there was something abnormal about them, in order to take the class-averages from a reasonably homogeneous group of samples. These excluded samples included most of those with very high counts (because these were sour or verging on sourness), so that if all had been counted the averages would have been still higher. Of course the milk from some dairies was far better than the average, and from others much worse.

Class.	No. of Samples.	Av. No. Bacteria per c.c.	Number having			
			Less than 1,000,000	1,000,000 to 5,000,000	5,000,000 to 10,000,000	Over 10,000,000
A. Bottled milk.....	32	6,000,000	8	13	6	5
I. From dealer.....	21	2,800,000	7	10	3	1
a. Pasteurized ...	18	2,400,000	6	10	1	1
b. Raw	3	5,100,000	1	0	2	0
II. From customers	11	12,200,000	1	3	3	4
a. Pasteurized ...	9	8,300,000	1	3	3	2
b. Raw	2	29,600,000	0	0	0	2
B. "Loose" milk.....	33	33,300,000	0	5	8	20
I. From dealers....	31	29,500,000	0	5	7	19
a. Pasteurized ...	13	27,400,000	0	0	3	10
b. Raw	17	23,400,000	0	5	4	8
1. Shipped	6	43,000,000	0	0	1	5
2. City milk...	10	6,400,000	0	5	3	2
II. From customers	2	.....	0	0	1	1
a. Pasteurized ...	1	5,600,000	..	..	..	..
b. Raw	1	180,000,000	..	..	..	..

Several interesting points appear in these figures:

(1) The superiority of the bottled milk. Comparing the samples obtained from the dealer, we find that the "loose" milk contained on the average 10 times as many bacteria as the bottled (29,500,000—2,800,000). Moreover all the samples with less than

one million bacteria per c. c. were among the bottled milk, while the majority of the very high counts came from the "loose" milk. If we consider only the pasteurized milk, the superiority of bottled milk is equally striking, the bacteria being there in the ratio of 1 to 11 (2,400,000 to 27,400,000). In the case of one dairy from which we had a number of samples—all pasteurized by the same machine—the same ratio of 1 to 10 was found to hold between the bottled and "loose" milk (1,400,000—14,000,000). The difference in such a case must arise from development of bacteria in the "loose" milk after pasteurization, unless possibly an originally poorer grade of milk is used for it; on either supposition, the figures are impressive testimony to the *sanitary* superiority of the bottled milk.

2. The increase of bacteria after the milk gets into the hands of the consumer. There were too few samples of "loose" milk obtained from customers to give reliable information, and the same is true of the raw bottled milk; but comparing the pasteurized bottled milk in the two sub-classes, it appears that the samples "From customers," which were taken at an average period of four hours after delivery, contained on the average four times as many bacteria (8,300,000 per c. c.) as the other samples purchased directly (2,400,000 per c. c.). In these cases, since the milk was kept in the bottle, the bulk of the deterioration undoubtedly arose from allowing the milk to become, or to remain, too warm. As a matter of fact, eight out of the eleven samples were above 60 degrees when we found them; at such temperature the bacteria could easily quadruple inside of four hours.

3. The fact that the pasteurized *bottled* milk gave the lowest average of any group (2,400,000 per c. c.). It should be remembered that this number cannot fairly be compared with the figures for raw milk, without bearing in mind as explained previously, that a given number of bacteria in pasteurized milk implies a much larger number of previous inhabitants. On the other hand, even this much of an advantage for the pasteurized milk disappears when we consider the "loose" milk, of which the pasteurized samples had actually a somewhat higher count than the raw ones (27,000,000 against 23,000,000). This rather looks as though the fact that the milk had been heated, tempts the milk-man to be more careless with it than with the raw milk.

4. The comparatively low numbers of bacteria found in the "city" milk—6,400,000 per c. c. This is much lower than the average for any other group of "loose" milk samples. All but one of these samples came directly from the producing dairy; and the smaller number should be credited to this greater freshness rather than to any greater cleanliness. Of course it is an advantage in any case.

Taken as a whole, these figures show a decidedly poor grade of milk and an unsatisfactory—not to say insanitary—milk supply. Bearing in mind that our samples included some which had been subject to pretty bad handling, and many from the class of milk

which may be well over 48 hours old when sold, this is not surprising. In fact the two phases of the investigation, into the history of the milk, and into the resulting condition thereof, lead to the same general conclusion. Of course there are exceptions; but THERE IS ALTOGETHER TOO MUCH POOR MILK. Such milk—even the bottled milk—is of much too high a bacterial content to be safe food for babies; and one is tempted to say that most of the "loose" milk is unfit for human consumption. It is possible to control the milk-supply sufficiently to remove some of the causes of this condition, and to improve the situation materially, if we make up our minds to grapple with the problem. What some other cities are doing to improve and guard their milk-supply, will be shown in a succeeding chapter.

From Bull. 56, Hygienic Laboratory.

CLEANING COWS PREPARATORY TO MILKING

CHAPTER III.

RELATION OF MILK TO BABIES.

The social and sanitary conditions of the home and the measures employed to prevent disease are very important questions, especially as they relate to the amount of infant morbidity and mortality in a community. Yet neither of these questions is of greater moment for this purpose than is the problem of pure milk, a good quality of which is a fundamental necessity. Without it, little progress can be made. In fact it is a measure to prevent the spread of disease.

Maternal nursing as a principle should be encouraged, but when this is impossible, clean milk should not only be within the reach of all the people, and especially the poor of our cities, but they ought to be unable to obtain anything else but clean milk, for other conditions invite disease and death. Although the need for clean milk is greatest among babies, older children, nursing mothers, invalids and others are vitally affected by it.

The requirements of good milk for infants are freshness, freedom from bacteria, cleanliness and proper temperature. Unclean milk stands next to parental ignorance as the most important cause of sickness and death among babies. The two causes are closely inter-related. Mothers when they find it necessary feed cows' milk on their own responsibility and frequently do not know the danger that lurks in the milk they buy and use. The solution of the problem requires not only education and knowledge, but pure milk. Without the latter, education can have but little effect.

The few thousand quarts of certified milk used in our city are an insignificant portion of the daily consumption of milk, and affect very few outside of the well-to-do classes. The general milk supply must be improved. The St. Louis Pure Milk Commission, a philanthropic organization, undertakes to supply many of the poor of this city a good quality of milk at a low price. The Commission hopes in this way to lessen the infant mortality of St. Louis. Thousands of dollars are accordingly contributed every year to support this organization. The permanent solution of the problem, however, requires such an improvement in the general milk supply of the city as will make it fit food for babies. The need of such commissions is a confession that the city is not doing its duty. Meanwhile hundreds of little children are dying from the consequences of the use of inferior milk.

Morbidity of Children.

In the investigation conducted by the St. Louis School of Social Economy in the summer of 1910 into the condition of bottle-fed babies, nine selected districts studied gave the general condition of 1,941 children under five years of age in those districts. It was found that a very large percentage of the whole number of children who were bottle-fed were being given ordinary dairy milk bought from adjacent bake shops or groceries or from the wagons selling loose milk and often from wagons selling a poor grade of milk. Of the sick bottle-fed cases suffering from digestive troubles it was discovered on revisitations in September that a very large percentage had died. In some districts the number was as high as 50 per cent of the whole number of cases so studied. And yet when the visitor found a baby sick, if possible she referred the case at once to the family physician or the nearest feeding clinic. Even this, however, was unable to counteract the evil effects of bad milk.

Among the poor throughout the city probably about 20 per cent of the babies use dairy milk or artificial food. Among the middle and well-to-do classes, however, the percentage of babies who depend on dairy milk is much larger, perhaps not more than 40 per cent being breast fed. Certified milk has some vogue among these classes, but the great majority depend on ordinary cows' milk. This therefore is the chief food of thousands of young children in this city, although it is one of the most common causes of disease. Adults likewise may suffer from certain diseases for which milk is a medium. Driven by the unwholesomeness of ordinary dairy milk a large number of housekeepers boil the milk in order to lessen the danger of disease. It is well known, however, that such milk thereby becomes less adaptable as food for babies and often is positively harmful. Yet boiling may be the lesser of two evils. **The healthfulness of children demands milk which is originally clean and which need not be subjected to such artificial processes.**

In the districts studied, which were comparatively poor sections, 84.5 per cent of the children under one were breast-fed; the remainder, or about one-seventh of the whole, were fed on cows' milk and artificial foods. The children over one were, of course, largely fed on cows' milk and ordinary table foods. This is especially important in connection with the diseases of the digestive system which occur so frequently during the second year of life.

Some of the effects of artificial feeding are apparent in the facts discovered among the cases canvassed in our investigation. It appears that the 15.5 per cent bottle-fed babies furnished more than half of the sickness occurring during the summer months and 74 per cent of the cases of digestive trouble. In other words **these cases were fifteen times as numerous among bottle and artificially-fed infants as among those nursed directly by their mothers.** Recent investigation in the tenement districts of New York City show the disproportions to be twelve to one.

Bad milk deteriorates so rapidly in the summer months, if not properly cared for, that diseases due to such milk are very common.

Our investigations showed that last summer in the districts studied the digestive and nutritional diseases furnished 61 per cent of all sickness among infants although the proportions for the entire year are little more than half as large. In other words the disease rate for digestive and nutritional diseases is almost doubled for the summer months. The reasons for this are very clear. Milk having a low bacterial count, such as "certified" or "Pure Milk Commission" milk is but an insignificant carrier of disease. It is the ordinary dairy milk, which according to our investigations contained almost countless bacteria, that is the chief factor in causing the digestive diseases. These bacteria, be it remembered, are present while the milk is still in the hands of the retailer—before it reaches the consumer. Whether the milk is well cared for by the consumer or not, the disease germs are already on hand and have rapidly multiplied owing to the slip-shod methods of producing and handling much of the dairy milk used by the citizens of St. Louis. The need of good milk and of intelligent care of the same by producers as well as consumers is therefore only too evident.

Impure milk causes contagious disease. In 1900 Dr. Kober reported to the International Medical Congress that 195 epidemics of typhoid, 90 of scarlet fever and 36 of diphtheria occurring in the United States had been directly traced to the use of infected milk. Unless properly inspected our dairy milk supply constantly threatens us with disease, especially diseases of children.

Again the total number of cows contributing to the milk supply which have been tested for tuberculosis and found free from disease is very small. St. Louis requires no test of cows either inside or outside the city. Where tests have been made it has been discovered that a very large proportion of the milch cows are afflicted with tuberculosis. That the disease germ is carried by milk no longer admits of question. It is now recognized that infection with tuberculosis through the use of milk is not only possible but occurs to a considerable extent. Much of this occurs in early life, that is children are infected, but the disease may develop at a later age period.

The National Association for the Study and Prevention of Tuberculosis, has urged the thorough inspection of dairies and herds and the production and handling of milk under proper sanitary conditions in order to reduce the mortality from tuberculosis. The Association holds that not only pulmonary tuberculosis, but to some extent other forms of the disease may be of bovine origin. Accordingly the milk supply needs to be carefully guarded.

Mortality of Children.

The School of Social Economy investigated the deaths of more than one thousand children formerly living in the east end of the city. Of this number 837 lived long enough to have a feeding history. The remainder died shortly after birth. A total of 372 of the children having such a history, or 44 per cent, died of digestive or nutritional disorders—a somewhat higher proportion than that for the city as a whole. On the other hand, the high proportion

of deaths throughout the city from these diseases indicates the universal presence of common causes. Chief among these causes as will be subsequently shown is the quality of the milk consumed.

The relation of this mortality to the character of food consumed by the child is a striking illustration of the influence of various methods of feeding. As shown before the great majority of babies are breast-fed, but **bottle-fed babies are the ones most subject** to disease. More than one-half of the babies dying under one year of age were bottle-fed. Only about one-fourth of the children dying from the digestive diseases were being breast-fed at the time of death, the remainder used cows' milk or milk substitutes. In view of this great disproportion, there can be no doubt of the deleterious consequences of the use of ordinary market milk.

The breast-fed baby of the alley with its many disadvantages has as good a chance for life during the first nine months as the bottle-fed baby of the avenue using cows' milk. The question of food is all important and only later do the insanitary conditions of the slums weaken the children of the poor.

The following table shows the total number of deaths of infants under one year and of children under five in St. Louis for the years 1909 and 1910 and also the deaths from digestive and nutritional diseases:

1909.	Children under one year.	Children under five years.
Total deaths	1,723	2,500
Deaths from digestive and nutritional diseases	726	832
1910.		
Total deaths	1,707	2,471
Deaths from digestive and nutritional diseases	647	766

It appears from these facts that the last year was somewhat more favorable than the previous year. The figures in the above table show that the total deaths in 1909 of infants under one from the digestive and nutritional diseases constituted 42 per cent of all deaths among children under one; the deaths of children under five, 33.2 per cent of all deaths among this age group, while in 1910 the proportion of deaths from these causes fell to 37.8 and 30 per cent respectively.

Other facts for the babies or children under one year of age are given in the following table:

Deaths from Digestive and Nutritional Disease During the Months June to September (inclusive).

	Children under one	Proportion of Deaths from all causes for three months	Proportion of Total Deaths from Dig. and Nut. Diseases for entire year
1909	398	55.8	54.8
1910	498	52.5	61.0

It appears from this table that while the deaths from digestive and nutritional disorders were fewer among the babies in 1910 than in the previous year, the number dying during the summer months was exactly the same. Consequently the proportionate loss during the last year was greater than before. Instead of 54.8 per cent of the deaths occurring during these four months 61 per cent fell within this period in 1910. In other words three-fifths of the deaths last year from two groups of diseases occurred during one-third part of the year, that is, the death rate was almost exactly three times as high during the summer months. This applies only to children under one.

On the other hand, in 1909 49.4 per cent of all deaths under five during the four summer months were due to these two causes and the proportion fell in 1910 to 49 per cent. Nearly half of all children dying under five during these months are victims of diseases depending to a large extent on the quality of milk and food consumed.

In spite of a cooler summer, and considerable expansion of the work of the Pure Milk Commission, last year shows but little advantage over the preceding one. The death rate from these two groups of diseases was reduced but slightly, whereas the weather conditions warranted a considerable reduction. When we remember that poor milk is the largest single cause of these disorders we realize how important is a good milk supply. The facts also force us to conclude that the milk furnished the city, has undergone little improvement during the past year as far as its general cleanliness is concerned.

The heavy mortality from the digestive diseases during the summer months needs explanation. It is not the direct effect of the heat that is so injurious as the effect on the babies food, which easily spoils, and produces sickness and death. Heat does not kill the babies. It is cows' milk improperly handled by dealers, coupled with the warm weather and ignorant care of this milk by mothers which is in large part responsible for the digestive diseases. Good milk is the first step in bringing about a reform. Without it care in handling milk is but an idle form.

The facts show that deaths from digestive diseases were prevalent during the summer months, only among bottle-fed babies. Out of 237 children in the east end of the city dying during the four hottest months only 75 had been restricted to breast-feeding, while the number of breast-fed babies dying showed practically no change in proportion throughout the year. Although the mortality among babies using cows' milk is heaviest in the summer months, this is not true of babies who are nursed exclusively. In fact our figures show a slightly smaller proportion among such infants for the summer months. This indicates that it is not heat, but the quality of food consumed which largely causes the deaths from these diseases. Again when we recall that the great majority of babies are nursed directly, but that 68 per cent of the children dying from digestive and nutritional diseases during the summer of 1909 in

CAN GOOD MILK COME FROM THIS DAIRY?

the district studied were being artificially fed, then the argument for good wholesome cows' milk becomes invincible. In other cities similar proportions exist between the fatalities among breast-fed and bottle-fed babies. For example, statistics taken by Dr. Goler of Rochester, N. Y., for the months July, August, September, 1908, show that out of 144 deaths under one, 84 per cent were bottle-fed. Accordingly there can be no question but that milk is an important factor in causing disease.

Experience of Other Cities.

The experience of St. Louis with its milk supply is being duplicated elsewhere. The New York City Department of Health in its annual report for 1904 gave the following reasons for a decrease of 62 per cent in its infant mortality from 1881 to 1903:

a. Purer milk secured through increased official watchfulness.
b. Pasteurization of milk by private philanthropies.

In order to lessen its infant death rate the city has taken the steps discussed in the following chapter. Private philanthropy has also been very active in supplying good milk to needy mothers with small babies.

In 1897 Rochester, N. Y., began a series of aggressive measures in favor of a cleaner milk supply. Attempts were made to raise the standards of dairies and the quality of milk was considerably improved. The value of good milk was especially shown by the results obtained from the work of the Health Department in providing stations supplied with the best quality of milk. This milk was recommended to mothers with remarkable results. Not only were the annual number of deaths among children greatly reduced, but the excessive death rate of the summer months was substantially modified. The disparity between the different seasons of the year was greatly reduced. In 1909 Chicago began a vigorous campaign to raise the standard of its milk supply in order that its infant death rate might be reduced. Other cities are doing similar work, with corresponding reductions in their child mortality. Why should not St. Louis?

According to a careful estimate made by Prof. Irving Fisher, of Yale University, 60 per cent of all deaths from the diarrheal diseases are preventable and the mortality of all children under one can be reduced substantially one-half. Such proportions applied to St. Louis indicate that at least 500 children can be saved annually from death due to digestive troubles and an additional 500 from other causes. The saving of the first 500 depends largely upon the success attained in securing a milk supply, free from impurities and noxious bacteria. Many of the deaths from the epidemic diseases are also due to milk infected with the fatal germ. In other cities such cases have been traced and the source of infection has often been located at one of the dairy farms supplying the city. The total mortality chargeable to bad milk, therefore reaches amazing proportions and we cannot remain blind to this needless suffering and loss of life, especially when the remedy lies close at hand.

The brief facts herein presented plainly show how important is good wholesome food for babies. Feed ordinary dairy milk and the mortality jumps to enormous proportions. Feed it during the summer months and hundreds of babies die. Both the rates of sickness and of mortality show this baneful influence. Yet milk is not intrinsically bad. It is the best substitute food for children. What then is the difficulty? Simply this, the milk supply of St. Louis needs to be produced under clean conditions by clean milkmen, be carried to St. Louis under proper refrigeration and when retailed meet the required standards of coolness. When a woman once remarked to Dr. Osler that Providence had taken her baby he replied, Providence had nothing to do with it, it was dirty milk; and the facts show that he was right. One of the most important methods of reducing the death rate and increasing the healthfulness of the people of St. Louis is the promotion of a better and purer dairy milk supply.

CHAPTER IV.

MILK REGULATION IN OTHER CITIES.

The following account of the milk regulation of a few American cities, deals only with the sanitary provisions. Practically all cities, as well as a number of states, prohibit the adulteration, skimming, or watering of milk. The sanitary side of the problem, however is more difficult; and on these points the methods of protection adopted in other cities give valuable suggestions, as to what can be done. This is especially true of the larger cities, because in them the situation—with the milk coming to the customer through one or two sets of middlemen—closely resembles that in St. Louis. The necessary precautions for getting a wholesome supply of milk are essentially the same everywhere:—cleanliness, protection from contagion, cooling, and prompt delivery. But the difficulty of enforcing them varies almost directly with the size of the city. This, however, is only the more reason why a large city must take vigorous measures to protect itself:

Washington, D. C.

Washington has a thorough system of dairy inspection, both within and without the District. The dairies in other States are controlled by a provision of the law, that no one "shall bring or send into the District of Columbia for sale any milk without a permit so to do from the health officer of said District," and that the permits shall be issued "on condition that none but pure and unadulterated milk shall be . . . brought into said District; that in the management of said dairy or dairy-farm said applicant shall be governed by the regulations of the health office of the District of Columbia . . . issued for dairies and dairy farms in said District . . . and that said dairy or dairy farm may be inspected at any time without notice by the health officer of the District of Columbia or his representative." These regulations are enforced by veterinary inspectors living in the country in the districts of which they have charge.

This was one of the earliest provisions for inspection by a city of dairies located outside of its limits; and it has worked very satisfactorily. Practically all cities which have such country inspection, follow a similar plan of requiring a permit for importing milk into the city, and of making it a condition for the granting of such a permit that the applicant abide by the requirements of the city in

question and agree to admit its inspectors; then a violation of the requirements is followed by a revocation of the permit and a prohibition of shipments from that source.

Washington also requires the tuberculin-testing of all milch cows in, or imported into, the District of Columbia, and the slaughter of all which are found to be tuberculous.

New York.

Milk comes to New York from many states, and through the hands of collecting creameries as in St. Louis, so that the New York Health Department has as complicated a situation to deal with as that of any city; and since the milk comes from greater distances (as far as 400 miles) than in the case of any other American city, it is by so much more difficult to secure a satisfactory milk supply. Though this has not been fully accomplished, still there are a number of excellent points about the New York system of inspection. Country inspectors are employed (20 in 1908), who inspect and report on the dairy farms as well as the creameries, in all the states which supply the city; where conditions are "notably insanitary" the company receiving that milk is notified not to accept it for sale in the city, and the prohibition is maintained until the bad features are remedied. Especial attention is given to the dairy water supplies, that they shall be free from contamination; also to the exclusion of milk from farms where there is unquarantined contagious disease. In the city there are an almost equal number of inspectors who make routine examinations of milk sold, and of the places where it is handled or sold. One of the commendable features of the New York regulations is that all milk found above 50 degrees, as well as milk that is sour, is forthwith destroyed. Also New York has for three years had rules governing pasteurization, which, among other items, forbid repasteurization, and require that pasteurized milk be placed in sterilized and sealed containers and sold within 24 hours.

There are five official grades of milk in New York ranging from "milk" to "certified milk," each of which is produced and sold under special regulations. The sanitary requirements for plain "milk" are, that it shall not be taken from cows fed on unwholesome food (including distillery waste) nor from cows "kept in a crowded or unhealthy condition," that its temperature shall not be higher than 50 degrees F., and that it shall not contain "an excessive number of bacteria." (Apparently 1,000,000 bacteria per c. c. or more is considered an excessive number; in 1908 25 per cent of 6,000 samples fell in that class.) In addition, it is required and enforced that all milk cans and bottles must be cleaned as soon as they are emptied.

Chicago.

Chicago, of all the large cities, is making the most vigorous attempt to safeguard its milk supply. It has an elaborate system of

regulations and inspection, protecting the milk from the time it is produced until it is retailed—hampered, however, by an insufficient number of country inspectors. There are rules for dairy farms, covering the health and care of the cows, the condition of the barnyard, the construction and cleanliness of the stable and milk-house, methods of milking and of care of the milk, construction and cleaning of milk utensils, water supply, and protection against contagious disease. The rules for milk depots (i. e. handling plants) prescribe in detail, freedom from contaminating surroundings, the construction, drainage, ventilation, and cleaning of the building, the condition and care of apparatus and utensils, the cooling of the milk, and the exclusion of communicable disease. Milk must not be exposed on the street or in the wagons; if it is bottled, this must be done at the depot, and if it is sold in bulk, it must be carried in a special can from which it can be drawn without dipping. Finally, none but bottled milk may be sold from stores. As the head of the milk-inspection service says: "We have succeeded in eliminating the old dipper method of milk-vending in stores and on wagons."

There is a bacteriological standard for milk on arrival of 500,000 per c. c. in the winter and 1,000,000 in the summer; the sale of milk containing over 3,000,000 per c. c. is prohibited, as is also that of milk containing any pathogenic bacteria.

The most prominent feature, however, of the Chicago milk situation, is the campaign against tuberculosis. All milk sold in Chicago must be either (a) from cows free from tuberculosis, as shown by the tuberculin test, or (b) pasteurized. The exception, moreover, extends only until 1914; and the pasteurization process is regulated and watched by the Health Department in order to ensure that it shall be efficient—that is, that it shall destroy 99 per cent of all the bacteria and all the pathogenic bacteria, in the milk. All continuous pasteurizing machines must be equipped with an automatic heat-regulator or an automatic temperature recorder. Pasteurized milk must be cooled to 45 degrees or less.

Chicago is the pioneer among the large cities in taking the advanced stand of enforcing the tuberculin test. It is stated by the officer in charge that by last November, one-third of all the cows supplying the city had been tested.

Boston.

Boston's regulations provide, in addition to requiring a license for the production and sale of milk within the city, that "no milk which is not produced or handled in a manner satisfactory to the Board of Health, shall be brought into, kept, delivered, distributed, sold or offered for sale in said city." The city has relied upon the State Board of Health for farm inspection, and confined its efforts to conditions within the city—the methods of handling the milk, and its bacteriological condition, for which 500,000 per c. c. is the standard. Among the rules for the handling of milk are the requirements that cans and bottles be cleaned immediately upon

From Bull. 80, Hygienic Laboratory.

A MODEL DAIRY

emptying, that only bottled milk be sold from stores, and that when milk is tested by tasting—a not uncommon practice—this shall be done by means of some implement (other than the hands of the taster) which shall not be used again until sterilized. The last matter, with the danger of contagion involved in careless tasting, is nevertheless one that is too frequently overlooked. Special attention is also given to enforcing thorough cooling.

When a dairy farm is adversely reported upon by the State Board, the dealer getting the milk from that farm is held responsible, and is notified to discontinue his purchases until conditions are improved. In most cases this step suffices to bring about the desired improvements; occasionally it is found necessary to prohibit importation from some farm permanently.

The following figures as to the bacteriological condition of the Boston milk for 1908 are of interest:

	No. Samples.	Under 500,000 per c. c.	Under 1,000,000	Over 1,000,000
Milk on arrival.....	4204	86.4%	92.9%	7.1%
Milk from wagons.....	1275	72.1%	85.2%	14.8%
Bottled	....	75.3%	.....	.....
Can	....	67.9%	.....	.....
Pasteurized milk from wagons—				
Bottled	47	91.5%	93.6%	6.4%
Can	141	60.3%	83.7%	16.3%
Milk from stores.....	281	43.4%	69.7%	30.3%

These last figures, which were obtained before the prohibition of the sale of can-milk in stores, confirm our finding in St. Louis that such milk is the worst of all grades of milk. The most striking feature of the Boston data is the fact of the existence of a considerable proportion of pasteurized milk, especially when not bottled, which contains very large numbers of bacteria. In fact, as in St. Louis, the "loose" pasteurized milk averages worse than the "loose" raw milk. It is also mentioned by the inspector that two firms whose raw milk on arrival showed the highest percentage of high count samples, are engaged in pasteurizing. This seems to indicate that milk which is pasteurized is apt to have been in worse condition before pasteurization, than the general average of the milk.

San Francisco.

San Francisco regulates its milk business under the permit system, essentially as in Washington, permits being required not only to produce or sell milk within the city, but also to "ship, send or bring" milk into the city. The applicant must satisfy the Board of Health that "the production, transportation, storage and handling of the milk is to be under sanitary conditions." "Permits shall be subject at all times to revocation by said Board of Health in its

discretion upon sufficient cause therefor shown," after a hearing; any refusal of any licensee to allow official inspection is specifically made a cause for revocation. San Francisco offers one original suggestion in the provision that when a permit has been revoked, no further permit shall be granted to the same person until he shall file with the Board of Health a bond for $500 for the faithful observance of the regulations of the law and of the Board.

RECOMMENDATIONS.

I. That a system of *permits* for all branches of the milk business be established, and especially that a permit be required to ship milk into the city.

II. That it be made a condition of the granting of all permits that the holders sign an agreement to comply with all the requirements of the ordinances, and of the Board of Health, and especially that all producers outside of the city who wish to ship milk into the city agree to produce and handle their milk in accordance with the rules of the Board of Health and to admit the Health Department inspectors; or if the shipper be not the producer that he agree to buy milk only from those who produce it under the above conditions.

III. That permits may be revoked by the Board of Health, after a hearing, for any violation of the agreement made by the holder.

IV. That when a permit has been revoked, the same person (firm or corporation) cannot obtain a new one unless he gives $500 bond for the faithful performance of his agreements.

V. That the prohibition of adulteration, skimming, and watering be left in charge of the City Chemist, as at present, but with an additional inspector.

VI. That the Board of Health be given authority to make all necessary detailed sanitary rules for all branches of the milk business; that the enforcement of the sanitary regulations be placed in charge of the Sanitary Division, and that in addition to the four city dairy inspectors at present employed, provision be made for eight country inspectors.

VII. That the existing requirements that milk be kept below 50 degrees F. be maintained, and reinforced by a provision for the confiscation and destruction of all milk found above 59 degrees.

VIII. That pasteurization be regulated so as to secure better results, and that double pasteurization be prohibited.

No recommendation is here made as to the elimination of tuberculous dairy-cattle, not because the subject lacks importance, but because it is so difficult that it seems better to take it up separately.

LIBRARY OF CONGRESS
0 000 896 088 4